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Environmental Effects of Dredging Technical Notes



CORPS OF ENGINEERS INITIATIVE TO DEVELOP LONG-TERM MANAGEMENT STRATEGIES FOR NAVIGATION DREDGING PROJECTS: OVERVIEW AND FRAMEWORK

PURPOSE: This note describes a major US Army Corps of Engineers (USACE) policy initiative to define an appropriate and effective framework for developing and implementing the concept of a Long-Term Management Strategy (LTMS) within the national navigation dredging program. It presents a five-phase conceptual approach or framework for developing an LTMS with emphasis on "lessons learned" and a summary of selected field experiences.

BACKGROUND: Because of the multifunctional aspects of the LTMS initiative, the USACE established an LTMS steering committee to develop a general LTMS process framework and policy guidance, select appropriate LTMS pilot demonstration projects, and prepare "lessons learned" and technology transfer procedures for nationwide use. A concept paper that outlines national criteria and steps to be taken in developing an LTMS for Federal navigation dredging projects has been developed. This LTMS process is being evaluated in a series of field demonstration pilot projects before being implemented as national policy.

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Introduction

In 1978, the USACE Dredged Material Research Program concluded that long-term dredged material management plans would not only offer greater opportunities for environmental protection at reduced project costs, but would also meet with greater public acceptance once they are adopted and implemented (Saucier et al. 1978). More recently, a number of prominent scientific and engineering groups have strongly recommended that the USACE develop the concept of an LTMS for navigation projects (Klesch 1987). Presently, the USACE is defining an

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appropriate and effective management process, procedures, and policy guidance for developing and implementing an LTMS within the national dredging program (Francincques and Mathis 1989).

Why LTMS?

The long-term management of dredged material depends upon the ability to find suitable dredged material relocation sites. The US Congress, Office of Technology Assessment (1987) has identified this as the largest problem facing the USACE national navigation dredging program. Many dredging projects, and in some cases, the project beneficiaries, routinely rely on cycle-to-cycle location of relocation sites. This approach often results in significant project delays, increased costs, and sometimes recurring needs to invoke emergency dredging procedures for nationally sensitive navigation projects.

Presently, interactions occur in a highly complex legal and regulatory environment. Our projects are governed by over 30 major Federal environmental statutes, executive orders and regulations, and consistency in their implementation is difficult, if not impossible in some cases, to maintain. Personnel turnover within the USACE and other regulatory and review agencies responsible for implementing these complex environmental requirements has resulted in considerable problems in the way the regulations are interpreted and applied. Unfortunately, this problem has been the norm rather than the exception in the way dredging operations have been conducted over recent years. Finally, this is an era of increasing public awareness of our projects and a public that not only desires but insists on participating in the process of selecting long-term dredged material management solutions.

National Criteria for Developing An LTMS

The following criteria have been established for Corps-wide guidance.

- The LTMS must include all foreseeable new work, operations and maintenance (O&M), and permit activities. The basic premise is that it is not in the best public interest to construct a Federal project if there are no reasonable assurances that the project can be maintained and anticipated benefits accrued over the long term.
- Wherever possible, the LTMS should be for the anticipated project life. The LTMS scope should incorporate all anticipated Federal projects as well as project beneficiaries' dredged material management needs to

ensure long-term project viabilities. For new projects, this should in all cases be for the established 50-year project economic life. For existing projects, the same 50-year horizon should also be the established target or goal, while recognizing that project-specific circumstances may, in certain projects, dictate a shorter time frame.

- The LTMS must fully address both structural and nonstructural alternatives for maintaining navigation. Every effort should also be made to seek means of reducing dredging requirements and costs for the individual navigation projects.
- Unless specifically prohibited by Federal statute, the LTMS must incorporate the full and equal consideration of all dredging and dredged material management alternatives. No one management option can be considered a panacea for dredged material, nor can it be ruled out a priori in the initial plan formulation process for reasons other than sound economic, environmental, and engineering ones.
- The LTMS must be timely, technically feasible, cost-effective, and environmentally acceptable as dictated by established Federal standards, criteria, and regulations.

LTMS Framework

The USACE has developed a consistent, logical procedure by which LTMS alternatives can be identified, evaluated, screened, and recommended so that the dredged material placement operations are conducted in a timely and cost-effective manner. The framework for LTMS development is shown in Figure 1. This framework is a five-phase approach and each phase in Figure 1 consists of steps or essential activities that lead to a certain level of decision-making before continuing on to the next phase.

Phase I - Evaluate Existing Management Options

This phase is intended to serve as the first level of assessment and decision-making. It should be undertaken for all USACE navigation projects as a sound management practice. An expanded flowchart of the steps that comprise phase I is provided as Figure 2. The initial step is to establish appropriate operational boundaries for LTMS development. This means setting limits on project analysis areas to include both the geographical extent of the boundaries and the time frame(s) within which the analysis will occur, taking into consideration both Federal and non-Federal activities (new work, operations and maintenance, and permits).

Once the LTMS study boundaries are set, the next step is to identify the dredging needs in terms of volumes, dredging frequency, and dredged material

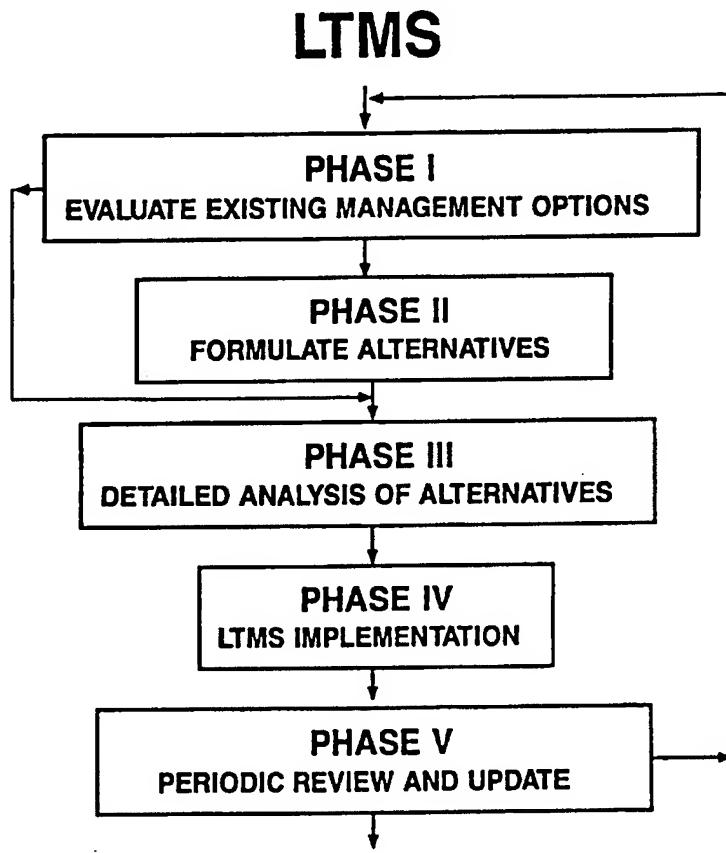


Figure 1. Phases of the LTMS process

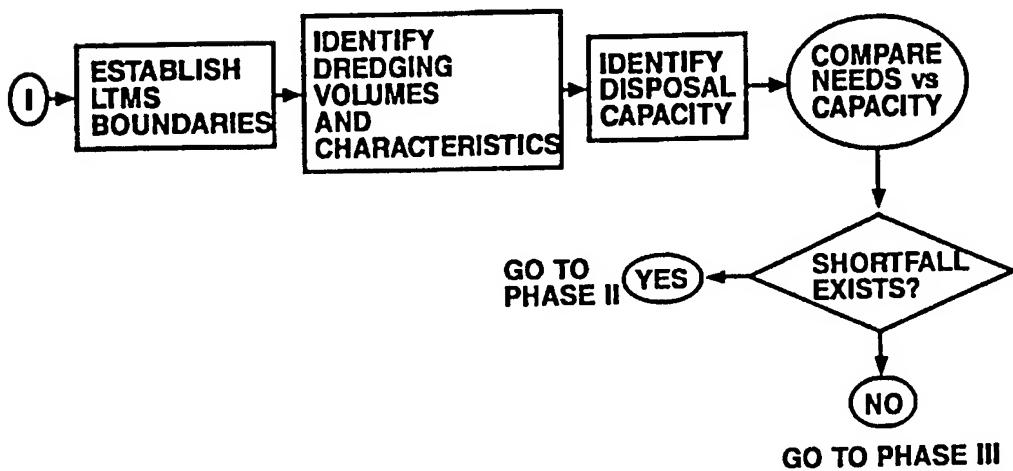


Figure 2. Phase I of the LTMS process

characteristics for the project or projects within the operational boundaries. Estimates should be made for existing and future work for both the Federal and non-Federal projects. Next, an identification and assessment of existing relocation site capacity should be made to allow for a comparison of needs versus existing capacities. A decision can be reached at this point as to whether there is a need to formulate management alternatives (Phase II) or to assess and document the long-term practicality of the existing management strategy (Phase III) prior to proceeding with implementation.

Phase II - Formulate Alternatives

The objective of Phase II is to systematically develop and retain all viable long-term management options that meet the study goals and objectives. To accomplish this, a series of steps have been identified and are presented in a flowchart (Figure 3).

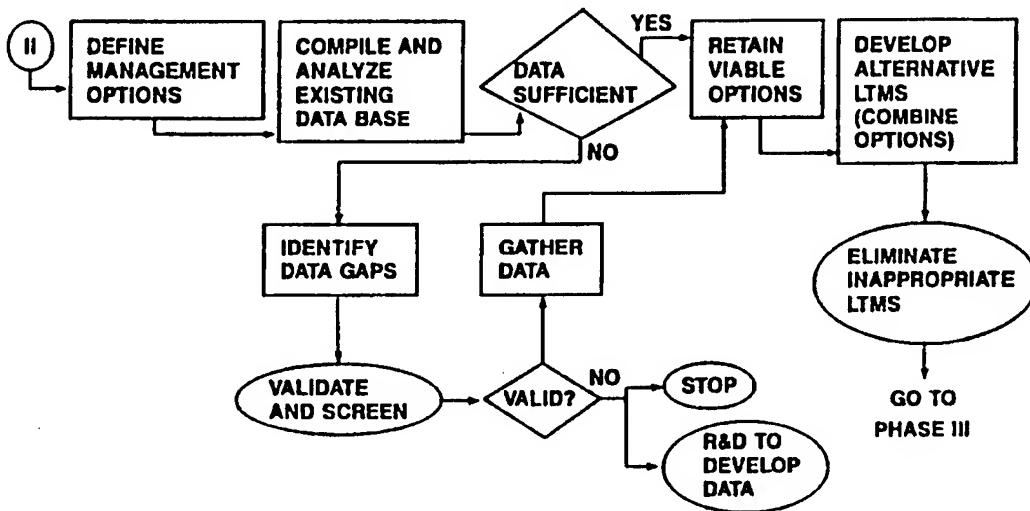


Figure 3. Phase II of the LTMS Process

Ideally, all available management options, including both structural and nonstructural alternatives, are defined consistent with the established LTMS goals and objectives. For example, a structural management option to reduce dredging volumes might include channel realignments and relocations or alternative measures such as the construction of wing dikes to reduce shoaling. An example of a nonstructural alternative could be a beneficial use such as beach

nourishment or marshland creation. Equal consideration must be given to using all media (upland, wetland, intertidal, and open water).

To evaluate the feasibility of the management options, the next step is to compile and analyze existing data associated with the various management options. There is usually a wealth of information available from a variety of Federal and non-Federal sources. The intent is to minimize the need for additional data collection activities, so a decision is needed as to the sufficiency of the existing data for evaluating the suitability of the various management options. If the data are sufficient, then the next step is to retain those feasible options for further use. If the background information is not sufficient, data gaps must be identified, validated, and screened, based on various factors such as potential for development, and time and resources needed to fill the gaps. If the needs are valid, then a data collection effort must be planned. Unvalidated requirements result in either no further evaluation of the management options or in research and development. Once the validated data requirements have been met, the next step is to combine the viable management options into reasonably attainable alternatives. A next level of screening is then made to eliminate the impracticable alternatives, that is, those which are not compatible with the study objectives (e.g., providing dredged material disposal and/or reducing the dredging requirements).

Throughout Phase II, it is important to fully involve the appropriate Federal and state resource agencies and affected groups (ports, environmental organizations, and local citizens). These organizations should be included in the decision-making process. However, we should not overlook that the USACE must retain the lead responsibility for directing, developing, and implementing the LTMS process for Federal navigation projects.

Phase III - Detailed Analysis of Alternatives

This phase provides for a thorough operational analysis of existing dredged material management plans (if no shortfall is identified) and the detailed evaluation, screening, and selection of a preferred long-term dredged material management strategy if a Phase II analysis is required. As envisioned, it is a comparative assessment analysis that weighs and balances engineering, economic, and environmental factors and benefits (see Figure 4).

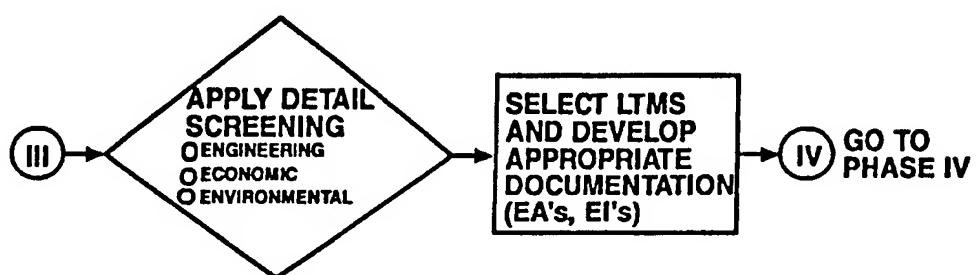


Figure 4. Phase III of the LTMS process

The purposes of Phase III are to select the most practicable strategy consisting of one or more alternatives for implementation and to provide the necessary in-house documentation needed to support this selection.

Phase IV - LTMS Implementation

The purpose of Phase IV is to develop the LTMS operations plan for implementing the selected LTMS. Consideration for this implementation plan development should include the administrative, procedural, management, and monitoring requirements (see Figure 5).

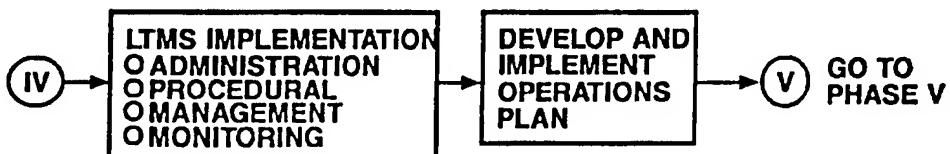


Figure 5. Phase IV of the LTMS process

Some operational considerations for implementation include:

- Environmental documentation for life of the plan.
- Long-term water quality certifications.
- Site-specific and regional permits/authorizations.
- Formalized regional mitigation strategies.
- Special Area Management Plans (e.g., regional plans with established zones favoring development versus resource protection).
- Implementation of site management requirements.

Phase V - Periodic Review and Update

The final phase in the LTMS process is a periodic reevaluation of the LTMS plan, based on changing regulations, economic and environmental conditions, and technological advances (see Figure 6).

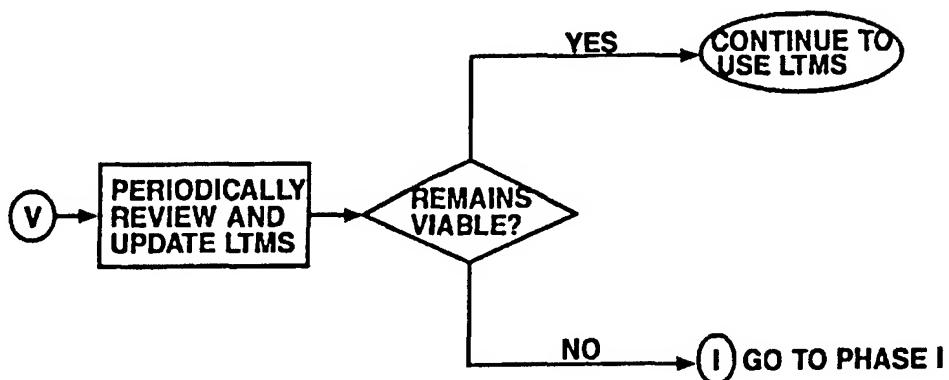


Figure 6. Phase V of the LTMS process

The intent of Phase V is to assure that decision-makers will maintain a viable implementation strategy which reflects changing times and project conditions, thereby avoiding the pitfalls of "crisis management." In the final analysis, the loop is closed, allowing the dredging manager to anticipate and accommodate changes in dredged material management needs and to document the validity of the technical, economic, and environmental long-term management decisions.

Pilot Demonstrations

Since 1987, two national LTMS demonstration studies have been initiated. The Maryland Port Administration (MPA), as the designated project sponsor, is developing a comprehensive Master Plan for long-term management of all dredged material from the Port of Baltimore. This Master Plan is funded solely by the MPA and was completed in October 1989. The study process being used by the MPA closely parallels that of the USACE LTMS conceptual process and provides a good basis for comparison with the second pilot study. This second study is being conducted by the US Army Engineer District, Portland, as a national USACE pilot demonstration. The LTMS study is being performed for the Federally funded maintenance program in the Columbia River Estuary.

Lower Columbia River Estuary LTMS

The Portland District is working cooperatively with the Port of Portland on a national pilot demonstration study involving an approximately 24-mile reach of the lower Columbia River near Astoria, OR. The study will address dredging and relocation annually of over 2.2 million cubic yards of sediment from the

estuary portion of the Columbia and Lower Willamette River Federal navigation project. The study is limited to the 40-foot-depth main navigation channel (river mile 4.4 to 28.0) and will not include dredging at the entrance bar.

The LTMS study process was initiated in February 1988 and has proceeded through the completion of the Phase II study in September 1989. The study is patterned after the phased approach previously discussed and shown in Figure 1. Presently, the study is limited to completing three phases over a two-year period. The planning time frame for the LTMS is 50 years and will be based on alternative analysis, including development, comparison, and selection of alternatives for maintaining the project.

In June 1989, the Portland District published a report on its Phase I activities (US Army Engineer District, Portland 1989). Information pertinent to navigation, environmental issues, and dredging are documented, along with important studies and regulatory considerations to be used in subsequent analysis during later phases of the study. The Portland District is presently preparing a report on its Phase II activities.

Some of the anticipated LTMS project benefits already identified by the Portland District are:

- Reduced cost and time required for annual project maintenance.
- Increased efficiency in regulatory coordination and permitting.
- Improved implementation of environmental quality and beneficial use project features.
- Improved long-range planning by operations personnel in dredge scheduling and contracting.
- Enhanced potential for local sponsor agreements, agreements with resource agencies, and other cost-sharing agreements.

Lessons Learned

The final report on the lower Columbia River Estuary LTMS study will include a section on "lessons learned" that will evaluate study activities in terms of usefulness towards developing an LTMS. Some of the "lessons learned" to date are:

- The overall District dredging program should be prioritized by project for development of an LTMS. It should also consider needs and resources available to conduct an LTMS.
- There is a need to separate the short- and long-term problems at a project when conducting an LTMS, and to develop solutions that can be implemented for each condition.

- A funding mechanism is needed to address the multi-year requirements for conducting an LTMS study. The budget for studies should include money for baseline field assessments where data are not available.
- An interdisciplinary study team should be established to develop the LTMS. This team should include the project sponsor as a decision-sharing partner in the process.
- Continuity of team member participation in the LTMS process is a major concern. Team member alternates should be designated to attend meetings and/or to perform team duties if the primary team members are unable to participate.
- The Operations Division in the Portland District should be responsible for developing the LTMS, but a full-time study manager will be required to coordinate the in-house and outside agency input and activities, and to prepare the necessary reports.
- Local sponsor and other public obligations and interests should be clearly identified early in the LTMS process. Attempts to develop and implement long-range solutions without their input cannot succeed.
- Involve public agencies after the study team has firmly and clearly established its role and responsibilities. Early in Phase II of the LTMS process seems to be an appropriate point to solicit public agency participation.
- Initial public agency involvement should be educational and aimed at establishing a common level of knowledge and understanding of the goal, objectives, and scope of the LTMS effort. There are different levels of technical expertise and experience in the public agencies as well as there are in the Federal agencies.
- Field trips to the LTMS study area including dredging and disposal operations will help Federal, state, and local government agency personnel to understand the dredging issues, to establish a better appreciation for the LTMS effort, and to develop a rapport with team members.
- It is important to document the results of the study team's efforts as the LTMS process proceeds. A technical summary report should be made available as soon as possible during Phase I of the study.
- When developing potential long-term management solutions, the consideration of beneficial uses of the dredged material has become a major driving force in gaining acceptance.
- There is a need to clearly define when to initiate the formal National Environmental Policy Act (NEPA) process in conjunction with formulation of alternatives developed for the LTMS study.
- Good cost estimation and economic assessments are essential components of the LTMS process. Both the District's economist and dredging estimators need to be involved early in development of the LTMS.
- Education is a major ingredient in developing an LTMS and this requires funding to host public meetings, workshops, technical seminars, and field trips. Support for these activities must be formalized as part of the LTMS budget.

Perhaps the most important "lesson learned" to date by the Portland District has been the need to clearly identify early in the process local sponsor and other public obligations and interests.

Summary of Selected Field Experiences

Based on the collective experience of USACE professionals and others during the past three years, there have been both successful and unsuccessful attempts to incorporate and implement the various elements of the LTMS process within their dredging management programs. Some of the more pertinent "lessons learned" can be grouped under the basic category of study methodology. A list of questions and answers relevant to study methodology was developed to present selected results of USACE field experiences.

- Is the USACE LTMS process framework a viable one?

The overwhelming response is yes. The Norfolk, New York, Mobile, Charleston, and St. Paul Districts have used approaches similar to the USACE LTMS process framework. In fact, the Port of Baltimore Master Plan development study is a good example of where the LTMS concept appears to be working with a great deal of success.

- How do you decide when to conduct an LTMS study?

Most long-term dredged material management studies have resulted from the shortage of approved relocation sites either due to changes in laws or implementing environmental regulations making certain sites impossible to find or use. Also, many Districts were finding that they were spending too much time and resources to obtain permits, rights of way, and public acceptance on one-time site-use operations. This problem, along with complications in budgeting and scheduling dredging projects, has made it extremely difficult to maintain certain navigation projects.

The bottom line for several Districts was that an LTMS for many projects is becoming a way of doing business, either by voluntary acceptance or through mandated court decisions. The New York Harbor long-range dredged material management study and plan is a direct result of a court-ordered requirement.

- Who should develop an LTMS?

As a matter of good business practice, the USACE and, for the most part, the port authorities and local sponsors should be active partners in developing long-range dredged material management plans. The USACE should take an active lead technical role in developing the LTMS where there is a definite Federal interest. In some cases, however, certain port authorities may need to assume this responsibility. For example, the Maryland Port Administration has assumed the lead role in developing the Master Plan for the Port of Baltimore. Whatever the arrangement

is, one thing is certain, the USACE should be involved in the LTMS process.

- What management structure has worked best when conducting the LTMS study?

There is a clear consensus within the USACE that the LTMS study should be accomplished by an interdisciplinary study team consisting of all USACE affected elements (planning, engineering, operations, regulatory and real estate) involved in the navigation program. There should also be a clear point of contact within the Study Team and District to direct the study and provide consistency in the implementation of the selected LTMS. Finally, it became obvious that the use of coordinating committees or advisory groups made up of various Federal, state, and local governments, private interest groups, and citizens is essential to developing a successful LTMS with the best chance for implementation.

- How long should it take to develop an LTMS?

While there was no prescribed time frame for developing a viable LTMS, most USACE study managers agreed that an average of about two years had been their experience. There were studies, however, where the issues and scope were so complex that two years was too short. These cases are particularly true where highly complex environmental issues have to be addressed. There was a common theme, however, that the USACE needed to "develop good long-term dredged material management plans, not long-term planning studies."

- What is considered to be long-term?

Long-term has different meanings to various groups. Some Corps Districts view long-term as three to five years, whereas, others use ten to fifty years. Most agree that USACE dredging regulation guidance (33 CFR 337.9 - Identification and Use of Disposal Areas) encouraging District Engineers "to identify and develop dredged material disposal management strategies that satisfy the long-term (greater than ten years) needs for USACE projects" is a good definition of "long-term."

- What are the sponsor's role and responsibilities in developing an LTMS?

The sponsor should play an important role in developing an LTMS. Responsibilities, however, will vary with the language of each project authorization. For example, in Norfolk District, in cases where the sponsor furnishes all lands, easements, and rights of way, this role should become a major one. The local sponsor must be willing to participate and assume responsibilities; otherwise, the USACE should not attempt to develop and implement the LTMS alone.

- Is the LTMS concept acceptable to local sponsors?

The general response is yes. The practice of short-term fixes usually results in navigation projects not being properly maintained and potentially impacts the local economy. In Norfolk, several District Engineers have refused to request O&M dredging unless long-term dredged material management requirements were met, which provided additional incentive to the local sponsor. The experience in the Norfolk District has shown that local sponsors have benefited greatly from the District's

long-term management policy because it has resulted in properly maintained channels.

Summary

Achieving dredged material relocation in a timely, technically feasible, cost effective, and environmentally responsible manner continues to be the major management problem facing the USACE national navigation program. The serious shortage of relocation sites, particularly upland, combined with traditional cycle-to-cycle dredging and relocation management practices, requires the development and implementation of long-term dredged material management strategies.

To address this difficult problem, the USACE has begun a major national policy initiative to define an appropriate and effective management process and framework for implementing the concept of an LTMS for the national dredging program. The framework for conducting an LTMS study has been developed and presented in this paper, along with a description of the pilot LTMS demonstration studies, with emphasis on the Columbia River Estuary LTMS study. A summary of "lessons learned" from this pilot study has also been presented.

A recommendation resulting from several meetings with USACE professionals is that if the LTMS conceptual process is to be a viable one, it must fully involve all affected program management elements including the USACE and individual port authorities as cost-sharing and decision-sharing partners in constructing and maintaining the Federal navigation system. Also, it must fully involve the Federal and state resource agencies and public and private sector groups, as appropriate, throughout the process with the USACE assuming a lead role responsibility for Federal projects.

There have also been a number of preliminary findings and institutional issues identified as a result of the USACE LTMS study initiative. Some of these can be summarized as follows:

- Project authorization may be the critical limiting factor in implementing LTMS plans.
- Program consistency is essential to the development of an LTMS; however, under existing laws, the USACE is unable to maintain a preferred level of program management consistency.
- Site management, both upland and open water, is essential to successful implementation of individual LTMS plans. The ownership and liabilities associated with materials placed upland are key issues needing more attention and USACE policy guidance.

- Cost sharing and funding of LTMS development are factors requiring resolution and/or clear guidance prior to agency-wide implementation of the LTMS process.
- Finally, whether the USACE has the ability to effectively implement individual LTMS plans is a major question that needs to be answered to assure a viable LTMS process that can be institutionalized. No doubt, there is considerable room for innovation in the area of LTMS plan implementation.

The effective resolution of the issues already identified, as well as those that will surely become evident in the future, is critical to the success of the LTMS initiative of the USACE. Plans are presently being made to hold a series of workshops to provide a forum for exchange of pertinent "lessons learned" by the USACE and others and to share experiences in solving long-range dredged material management problems.

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